THE PALEOZOIC FORMATIONS NORTH OF THE SAN SABA RIVER IN MASON COUNTY, TEXAS

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Dean of the Graduate School.

August 25, 1931.

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THESIS

Presented to the Faculty of the Graduate School of
The University of Texas in Partial Fulfillment of the Requirements

For the Degree of

MASTER OF ARTS

By

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Austin, Texas

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PREFACE

It was through the suggestion of Dr. E. H. Sellards that I have made a study of this area.

I wish to acknowledge my indebtedness to Dr. Sellards for his help in the field work and for suggestions, criticism and encouragement. I also wish to thank Mr. F. B. Plummer of the Bureau of Economic Geology for the help and encouragement which he has given. I am indebted to Dr. F. H. Lahee and Mr. D. M. Collingwood of the Sun Oil Company for suggestions in making this survey. Mr. Kurt Martin of Mason, owner of the Blockhouse Ranch which includes most of the area studied and Mr. Seth Kothman, foreman of the Ranch, have lent a great deal of assistance in the field work done in preparing this report.

I am grateful to Mr. G. R. Sparenberg and Mr. I. G. Davis of Austin for their assistance in the field work.

There are many others to whom I am sincerely grateful for their help in making this report possible.

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THE PALEOZOIC FORMATIONS OF NORTHWEST MASON COUNTY

DESCRIPTION OF AREA

The area which this survey covers is small and of triangular shape and is located in the extreme northwest part of Mason county, Texas. It is bounded on the north by McCulloch County, on the west by Menard County, and on the south and east by the San Saba River which is a tributary of the Colorado River. The area lies almost wholly within the Martin or Blockhouse Ranch. The ranch house which is near the center of the area is about 20 miles northwest of Mason, the county seat of Mason County.

The old Blockhouse from which the ranch derives its name is still used as a dwelling house. It is a two story log house which was used as a fort in the early days when Indian raids were frequent.

METHODS USED IN MAKING SURVEY

After walking over the area for a few days and becoming familiar with the formations a plane table map was started. Since there were no bench marks in the area and no

points of known elevation, a traverse was run to the area from a U. S. Coast and Geodetic Survey bench mark on the Mason-Brady highway. This bench mark is about three miles south of Camp San Saba in McCulloch County and was established in 1931 on a line run south from Brady. From this point a traverse was run along the highway North to the San Saba River and from there southwest up the river to the McCulloch-Mason County line. This point on the county line marks the extreme east point of the area which this report includes. The traverse was then carried on up the river to the Menard-Brady road which is about one-half mile west of Mason-Menard County line. The traverse then follows the road north for about two miles where it turns due east and runs 1500 ft. to the Mason-Menard-McCulloch County Corner. From this point which is marked by a small stone monument the traverse was carried east following the county line fairly closely to the point of starting which was at the north county line-river intersection. Thus the area was completely enclosed in a line of marked stations. Cross traverses were then run over the more important topographic features by connecting with the line of base stations. For the most part these traverses checked back in on known elevations very well but some error developed due to the fact that the areas

of greatest relief made necessary numerous angle shots thus causing the usual instrumental error which developes from this type of work. Stadia tables published by the Texas Reclamation Engineer were used in calculating elevations.

Notes were taken on the geology while the topography was being mapped, and with the previous reconnaissance work in the area, fairly detailed notes were obtained.

A section was accurately measured in Calf Creek which is the main topographic feature of the area aside from the San Saba River. This was the only place in the area where a good section of the Wilberns formation was available.

PREVIOUS WORK IN AREA

Aside from an obsolete United States Geological Survey topographic map of this area there was no base map available for use in studying this problem. For this reason it was necessary to make a topographic map before much definite knowledge could be gained about the geology.

Several geologists have spent a little time each on a study of this Cambrian section but no one has published on the area or made a detailed study of it, so far as I am able to learn.

PHYSIOGRAPHY

Topography

The triangular area included in this report is a part of north side drainage area of the San Saba river. The northwest portion farthest from the river is flat and almost featureless but both south and east from this part the relief is comparatively rough. The maximum relief of the area is from the river bed on the east, to the northwest corner of the county, and is about 220 ft. There are two intermittent streams of good size in the area, the larger, Calf Creek, in the northwest portion, and the smaller, Hog Creek, which runs into the river in the extreme eastern part. These two creeks have cut deeply into the massive parts of the Wilberns and in several places form cliffs 70-80 ft. high. There are innumerable dry stream beds in the area which have cut more or less shallow drainage systems up from the river for a mile or so. Higher up from the river there are frequently flats often several hundred yards across but near the river ~~the river~~ the relief is about the same throughout the area, except where the larger creeks flow into it.

Drainage

The drainage in this area is south and southeast in direction. The south side of the area is bounded by the San Saba River which drains all of the country immediately to the north. There is almost no gradient to the river in some places while in others there are rapids and small falls. The water varies in depth from a few inches to ten feet or more. In very dry summers the river goes entirely dry and with the exception of a few deep holes there is often no water in the river bed for months at a time. All of the streams which flow into the river are intermittent and some of the smaller ones have very steep gradients.

Vegetation

Away from the river in this area the trees are mainly mesquite and scrub live oak with a very few cedars while in the river bottom pecan, sycamore, willow, elm and oak predominate. In years of abundant rainfall the area is fine grazing land but in dry years little or no grass grows. Cactus, Spanish dagger and thorn bushes grow in abundance.

STRATIGRAPHY

Cambrian

Rocks of Cambrian age cover most of the surface in this area although Cambro-Ordovician and some Cretaceous rocks are present. The Cap Mountain and Wilberns formations make up the entire section of the Cambrian. The lowest formation in the Texas Cambrian, the Hickory sandstone, is not present in the area and was not observed closer than eight or ten miles away.

The Cap Mountain formation has been described in the Llano Quadrangle as follows:

> The formation includes about 90 ft. of beds, the lower portion grading from sandy limestone to fairly pure limestone. The sandstone member, though of irregular thickness, as just stated, is as a rule very well defined both below and above. The limestone is well bedded, in places flaggy, bluish or grayish, and mottled by impure streaks of brown sandy material.[1]

The top of the Cap Mountain formation at Packsaddle Mountain is described as follows: "Yellow and white sandstone with small amount of glauconite grading up into sandy pink limestone."[2]

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[1] Paige, Sidney, "Llano-Burnet Folio," United States Geological Survey, Folio 183, 1912, p. 6.

[2] Ibid.

At the base of the section taken on Calf Creek about seven feet of brown and yellow sandstone is present in the creek bed and above this is a thin layer of limestone which is overlain by a pink sandy limestone. This seems to agree very well with the Packsaddle Mountain section contact between the Cap Mountain and Wilberns.

This division between the Cap Mountain and Wilberns is subject to revision however. Sellards and Ulrich through field study report that the algae bed facies are probably in the Wilberns formation.[3]

The Packsaddle Mountain section gives almost six feet of coarse quartz sand below the uppermost sandstone, and below this 65 ft. of crystalline limestone and subcrystalline limestone grayish-brown in color and containing some glauconite.[4] Below the sandstone described in the Calf Creek section there is an undeterminable thickness of brown and gray crystalline limestone and sandy limestone which is exposed along the river banks down stream for about 3 miles. Due to faulting, change of dip, and the presence

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[3] Personal interview with Sellards.

[4] Paige, Sidney, "Llano-Burnet Folio," United States Geological Survey Folio 183, 1912, p. 6.

of innumerable so-called "algae heads" over which the bedded limestone folds, it was impossible to measure the thickness of these beds. A conservative estimate on their thickness, however, would seem to show not less than 150-200 ft. in the area.

The sandstone at the top of the Cap Mountain varies somewhat throughout the area but its thickness and general character are quite constant. In some places a quartzite has been formed at the top of the bed. The greater part of the formation is made up of limestones and sandy limestones of varying color and crystallinity which in many places are very indistinctly bedded. In localities where the bedding can be seen the limestones show beds of from two to ten feet in thickness and the sandy limestones are massive and unbedded and are ten or twenty feet thick.

Section of Cap Mountain at Calf Creek and Northeast Along the San Saba River

	Ft.	In.
Wilberns at top ?		
Yellow and white sandstone	7	6
Brown and gray crystalline limestone and glauconitic sandy limestones. Algae abundant	200 - 150 ?	
	200	?

The Wilberns formation as described in the Llano-Burnet Folio is from seventy to two hundred and eight feet in thickness in varying sections. The formation on the Colorado River is 208 feet in thickness and is made up of alternating beds of limestones, shales, and conglomerates.

The "edgewise conglomerate" zone occurs about the middle of the Wilberns section along the San Saba River. This unusual conglomerate has been described from the Wilberns in Llano and Burnet counties[5] and has been seen by the author in the Wilberns along the Llano River in the southwestern part of Mason County. The stratum is not over two feet in thickness and is made up of a gray crystalline limestone matrix with included oblong and flat rounded pebbles of limestone similar to the matrix which are oriented perpendicular to the bedding plane. The axes of the pebbles are oriented at right angles or at varying degrees from the bedding plane surface.

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[5] Paige, Sidney, "Llano-Burnet Folio," United States Geological Survey Folio 183, 1912, p. 6.

Throughout the area there is a fine grained yellow-brown limestone immediately below the massive gray limestone beds of the Ellenburger which serves as a very good marker for the top of the Wilberns. This limestone is very fine grained and contains much less glauconite than similar beds farther down in the formation.

The Cambrian of Texas is correlated with the Regan sandstone of Oklahoma, and with the Upper Cambrian of Missouri.[6] The Collier shale of Arkansas and Oklahoma, which is probably of Cambrian age, differs lithologically and is unfossiliferous and its exact correlation is unknown.[7] The Arbuckle limestone of Oklahoma, of which the basal part is Cambrian, carries two species of Billingsella. This genus of brachiopods is found in several localities in the Cambrian in Texas. In the area under consideration there is a horizon of brachiopods about the middle of the Wilberns which are similar to Billingsella coloradoensis Shumard.[8]

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6 Paige, Sidney, "Llano-Burnet Folio," United States Geological Survey, 1912, p. 7.

7 Croneis, Carey, "Geology of the Arkansas Paleozoic Area." Arkansas Geological Survey, Bulletin No. 3, p. 92-93.

8 Wolcott, C. D., Cambrian Brachiopoda. Monograph No. LI of The United States Geological Survey, 1912, p. 751.

Section of Wilberns along Calf Creek

	Ft.	In.
Ellenburger limestone at top.		
Brown fine grained limestone, small amount conglomerate	1	
Gray fine grained crystalline limestone	8	
Brownish highly conglomeritic crystalline limestone	1	
Gray highly crystalline limestone, small amount glauconite	1	
Pink crystalline limestone glauconite abundant, few brachiopod fragments	2	
Smooth gray fine grained crystalline limestone	5	
Brown fine grained sandy limestone	3	
Fine grained brown limestone	4	
Conglomeritic gray crystalline limestone		6
Fine grained brown and reddish-brown limestone	10	
Alternating beds of conglomerate and coarsely crystalline limestone, small amount glauconite	4	
Coarse conglomerate in highly crystalline gray limestone	1	
Gray highly crystalline glauconitic fossiliferous limestone	2	
Brown crystalline limestone glauconite abundant, trilobite fragments	4	
White sandstone glauconite abundant		6
Greenish-brown galuconitic limestone, trilobites gastropods	1	

Section of Wilberns along Calf Creek

	Ft.	In.
Brownish banded sandstone	1	
Gray-brownish sandy limestone, abundant trilobite remains, few pieces conglomerate, Billingsella sp.	1	
Medium fine grained gray-green glauconitic limestone, calcite inclusions frequent		6
Gray crystalline limestone, few well rounded pebbles conglomerate	3	
Very coarse conglomerate, sandy glauconitic cement thin even-grained bed of sandstone near top of bed	2	
Brown glauconitic crystalline limestone	1	
Fine grained gray clauconitic limestone	2	
Fine grained brown crystalline limestone, some glauconite upper part shaly	3	
Alternating beds of fine gray crystalline limestone and thin layers of glauconitic shale and conglomerate, zone of edgewise conglomerate	12	
Gray-white conglomeritic limestone		6
Hard highly glauconitic shaly limestone	3	6
Alternating beds of glauconitic shaly limestone and medium grained conglomerate in gray crystalline coarse grained limestone	8	
Pink crystalline limestone, trilobite fragments	1	
Brown crystalline limestone, small amount of glauconite		6
Cap Mountain at bottom ?	87	0

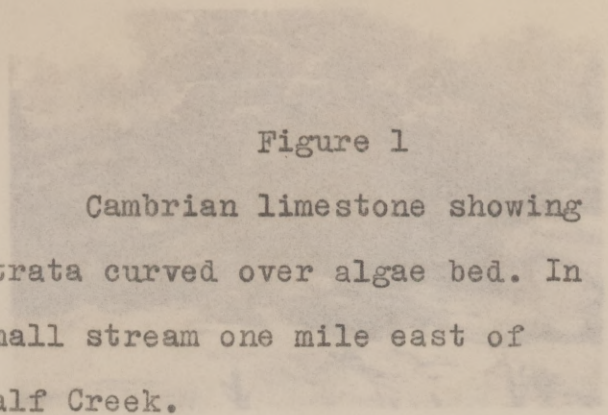

Figure 1

Cambrian limestone showing strata curved over algae bed. In small stream one mile east of Calf Creek.

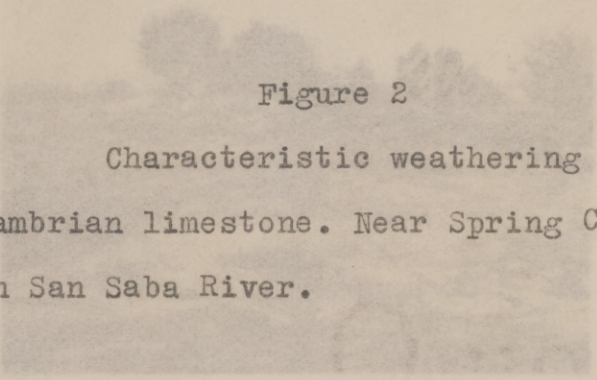

Figure 2

Characteristic weathering of Cambrian limestone. Near Spring Camp on San Saba River.

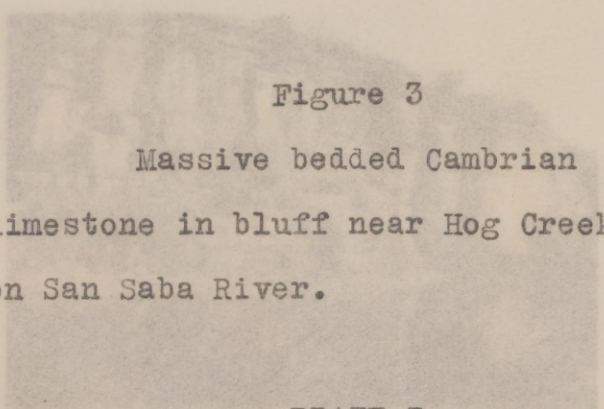

Figure 3

Massive bedded Cambrian limestone in bluff near Hog Creek on San Saba River.

PLATE I

Figure 1

Figure 2

Figure 3

PLATE I

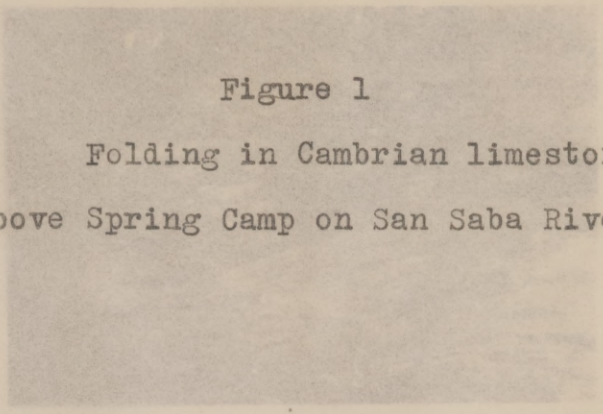

Figure 1

Folding in Cambrian limestone above Spring Camp on San Saba River.

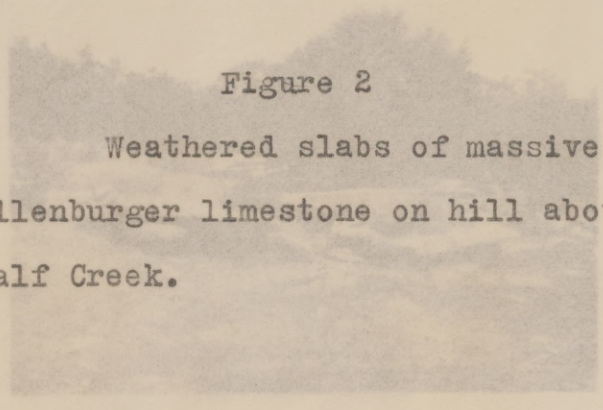

Figure 2

Weathered slabs of massive Ellenburger limestone on hill above Calf Creek.

PLATE II

Figure 1

Figure 2

PLATE II

This form was described from localities in Llano and Burnet Counties from Upper Cambrian rocks. There are also abundant Trilobite and small gastropod remains in the sandy glauconitic limestones of the middle Wilberns. Very little work has been done on the fauna of the Texas Cambrian and time was not available for making a study of this problem.

Cambro-Ordovician

The Ellenburger limestone of Cambro-Ordovician age is present only in the west and parts of the north side of the area. Its thickness here is probably not greater than 100 feet. The base of the Ellenburger is not far below the points of highest relief in the area and the Cretaceous sediments on the west leave only a narrow strip exposed.

Section of Ellenburger along Trail West of Calf Creek

	Ft.	In.
Massive gray limestone with brown inclusions	5	
Gray shaly finely crystalline limestone, inclusions of brown limestone	15	
Gray fine grained hard flaggy limestone, coiled forms and trilobite remains	25	
	45	

Wilberns at base

Cretaceous

Rocks of Comanchean Cretaceous age overlie the Cambro-Ordovician limestone in the northwest part of the area. Soil and Cretaceous float cover possibly one square mile in the corner of Mason County.

STRUCTURE

The Cambrian and Cambro-Ordovician rocks in this area have a general northwest dip of from two to five degrees and the strike is about forty degrees northeast. Frequent faults give local reverse dips in the area and some few small folds with northeast-southwest axes are present. There are without doubt some faults having considerable throw in the area but no idea of their displacement could be arrived at due to the similarity of the beds of limestone in which they lie. The faults have a general northeast-southwest trend for the most part but faults at right angles to these are not infrequent.

Only late Cambrian rocks are found in the Llano region indicating that there was a high land mass here in early Cambrian times. The Hickory sandstone which is the oldest of the Texas Cambrian deposits was laid down on the eroded metamorphic rocks which were formed after this area had been subjected to intrusions and other profound metamorphic agencies in Pre-Cambrian times.

The conglomerates and sandstones of the Cambrian in this area indicate a slow quiet submergence of the sea which was not greatly changed until after the Ellenburger limestone of Cambro-Ordovician times was deposited. After

the Ellenburger was deposited there was another period of a high land mass in this area as indicated by the absence of sediments from Ordovician to Mississippian time. Pronounced faulting and some folding occurred in this region in Pre-Cretaceous time.

The geologic map of the area which is included in this report gives some idea of the local structure which was not definitely mapable.

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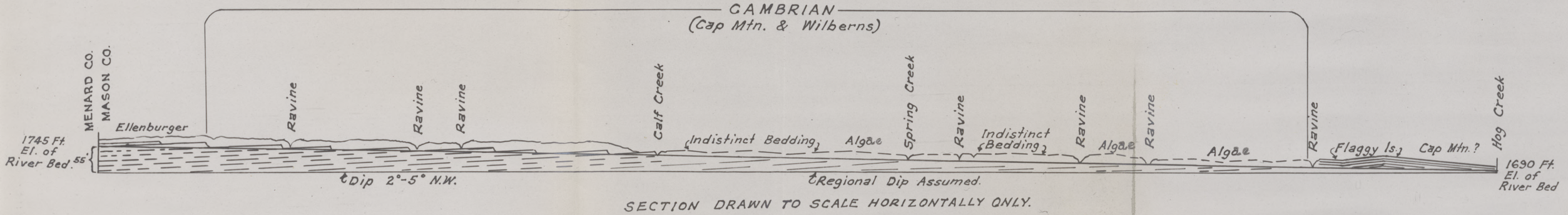
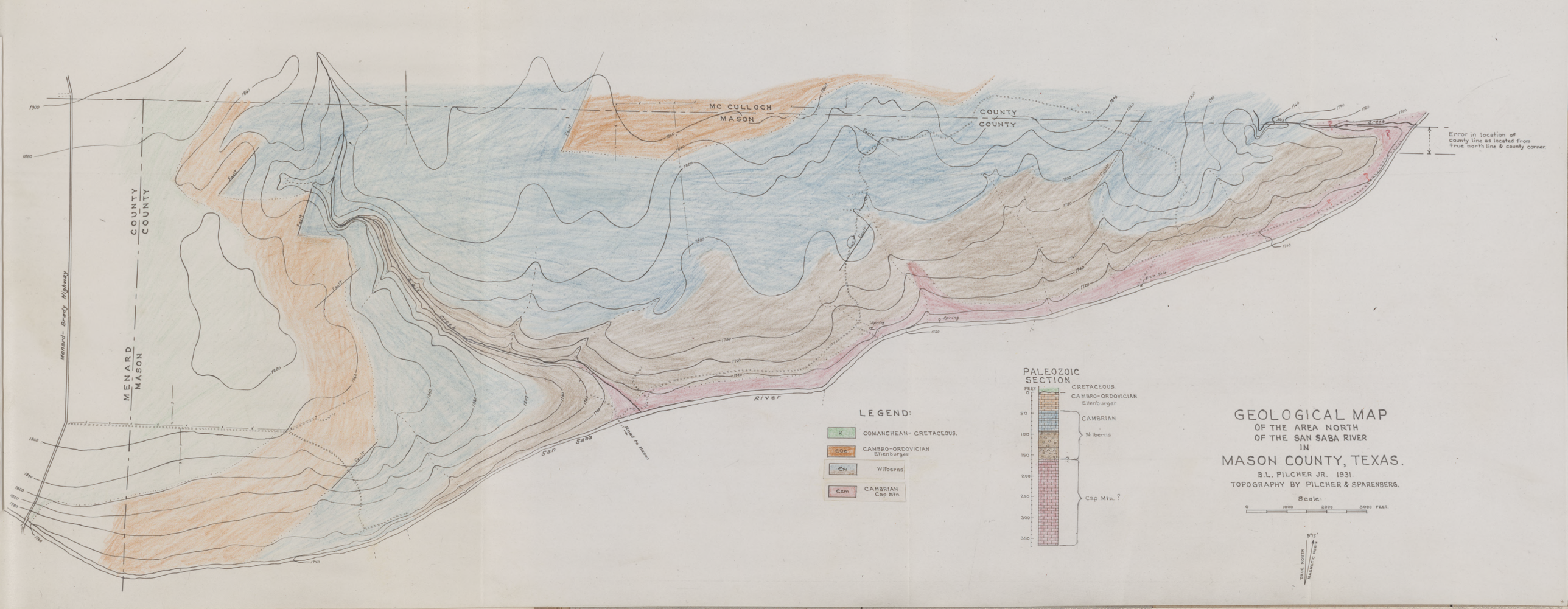


SECTION DRAWN TO SCALE HORIZONTALLY ONLY.

GENERALIZED SECTION ALONG SAN SABA RIVER IN NORTHWEST MASON COUNTY

Ben L. Pilcher Jr.



GEOLOGICAL MAP
OF THE AREA NORTH
OF THE SAN SABA RIVER
IN
MASON COUNTY, TEXAS.

B.L. PILCHER JR. 1931.
TOPOGRAPHY BY PILCHER & SPARENBERG.

Scale:
0 1000 2000 3000 FEET.